33nd International Conference on Foundations of Software Technology and Theoretical Computer Science

FSTTCS 2013, December 12–14, 2013, Guwahati, India

Edited by
Anil Seth
Nisheeth K. Vishnoi
# Contents

Preface ix
Conference Organization xi
External Reviewers xiii

Invited Talks

Polar Codes: Reliable Communication with Complexity Polynomial in the Gap to Shannon Capacity
Venkatesan Guruswami .......................................................... 1

Computing With a Fixed Number of Pointers
Martin Hofmann and Ramyaa Ramyaa ........................................ 3

On Approximation Resistance of Predicates
Subhash Khot ................................................................... 19

Characterisations of Nowhere Dense Graphs
Martin Grohe, Stephan Kreutzer, and Sebastian Siebertz ............... 21

Intersection Types for Normalization and Verification
Kazushige Terui ................................................................. 41

Contributed Papers

Session 1A

Polynomial Kernels for \(\lambda\)-extendible Properties Parameterized Above the Poljak-Turzík Bound
Robert Crowston, Mark Jones, Gabriele Muciaccia, Gevarghese Philip, Ashutosh Rai, and Saket Saurabh ............................................................... 43

On the Parameterised Complexity of String Morphism Problems
Henning Fernau, Markus L. Schmid, and Yngve Villanger .................... 55

Partially Polynomial Kernels for Set Cover and Test Cover
Manu Basavaraju, Mathew C. Francis, M. S. Ramanujan, and Saket Saurabh .... 67

Parameterized Complexity of the Anchored \(k\)-Core Problem for Directed Graphs
Rajesh Chitnis, Fedor V. Fomin, and Petr A. Golovach .......................... 79

Session 1B

Böhm Trees as Higher-Order Recursive Schemes
Pierre Clairambault and Andrzej S. Murawski ........................................ 91

Evaluation is MSOL-compatible
Sylvain Salvati and Igor Walukiewicz ........................................... 103

Editors: Anil Seth and Nisheeth K. Vishnoi
Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany
Contents

Model Checking and Functional Program Transformations
Axel Haddad ......................................................... 115

A Theory of Partitioned Global Address Spaces
Georgel Calin, Egor Derevenetc, Rapak Majumdar, and Roland Meyer .......... 127

Session 2A

A Strong Direct Product Theorem for the Tribes Function via the Smooth-Rectangle Bound
Prahladh Harsha and Rahul Jain ........................................... 141

Inapproximability of Rainbow Colouring
L. Sunil Chandran and Deepak Rajendraprasad .................................. 153

Session 2B

Primal Infon Logic: Derivability in Polynomial Time
Anguraj Baskar, Prasad Naldurg, K. R. Raghavendra, and S. P. Suresh .......... 163

Composition Problems for Braids
Igor Potapov ............................................................... 175

Session 3A

DLOGTIME Proof Systems
Andreas Krebs and Nutan Limaye ........................................... 189

On Improved Degree Lower Bounds for Polynomial Approximation
Srikanth Srinivasan .......................................................... 201

Session 3B

Implementing Realistic Asynchronous Automata
S. Akshay, Ionut Dinca, Blaise Genest, and Alin Stefanescu ......................... 213

Computation of Summaries Using Net Unfoldings
Javier Esparza, Loïg Jezequel, and Stefan Schwoon ................................ 225

Session 4A

Faster Deterministic Algorithms for $r$-Dimensional Matching Using Representative Sets
Prachi Goyal, Neeldhara Misra, and Fahad Panolan .................................. 237

Distributed and Parallel Algorithms for Set Cover Problems with Small Neighborhood Covers
Archita Agarwal, Venkatesan T. Chakaravarthy, Anamitra R. Choudhury, Sambuddha Roy, and Yogish Sabharwal ........................................... 249
Replica Placement via Capacitated Vertex Cover
Sonika Arora, Venkatesan T. Chakaravarthy, Neelima Gupta, Koyel Mukherjee, and Yogish Sabharwal 263

Knapsack Cover Subject to a Matroid Constraint
Venkatesan T. Chakaravarthy, Anamitra Roy Choudhury, Sivaramakrishnan R. Natarajan, and Sambuddha Roy 275

Session 4B
Jumping Automata for Uniform Strategies
Bastien Maubert and Sophie Pinchinat 287

Emptiness Of Alternating Tree Automata Using Games With Imperfect Information
Nathanaël Fijalkow, Sophie Pinchinat, and Olivier Serre 299

Saturation of Concurrent Collapsible Pushdown Systems
Matthew Hague 313

Decidability Results on the Existence of Lookahead Delegators for NFA
Christof Löding and Stefan Repke 327

Session 5A
Fair Matchings and Related Problems
Chien-Chung Huang, Telikepalli Kavitha, Kurt Mehlhorn, and Dimitrios Michail 339

Ranking with Diverse Intents and Correlated Contents
Jian Li and Zeyu Zhang 351

Session 5B
Separating Regular Languages by Locally Testable and Locally Threshold Testable Languages
Thomas Place, Lorijn van Rooijen, and Marc Zeitoun 363

On the Structure and Complexity of Rational Sets of Regular Languages
Andreas Holzer, Christian Schallhart, Michael Tautschnig, and Helmut Veith 377

Session 6A
Geometric Avatar Problems
Mario E. Consuegra and Giri Narasimhan 389

Clustering With Center Constraints
Parinya Chalermsook and Suresh Venkatasubramanian 401
## Session 6B

On Infinite Words Determined by Stack Automata  
*Tim Smith*  
413

The Combinatorics of Non-determinism  
*Olivier Bodini, Antoine Genitrini, and Frédéric Peschanski*  
425

## Session 7A

Renting a Cloud  
*Barna Saha*  
437

Energy Efficient Scheduling and Routing via Randomized Rounding  
*Evripidis Bampis, Alexander Kononov, Dimitrios Letsios, Giorgio Lucarelli, and Maxim Sviridenko*  
449

PTAS for Ordered Instances of Resource Allocation Problems  
*Kamyar Khodamoradi, Ramesh Krishnamurti, Arash Rafiey, and Georgios Stamoulis*  
461

On the Pseudoperiodic Extension of $u^ℓ = v^m w^n$  
*Florin Manea, Mike Müller, and Dirk Nowotka*  
475

## Session 7B

Solvency Markov Decision Processes with Interest  
*Tomáš Brázdil, Tuocue Chen, Vaňiček Forejt, Petr Novotný, and Aistis Simaitis*  
487

Parameterized Verification of Many Identical Probabilistic Timed Processes  
*Nathalie Bertrand and Paulin Fournier*  
501

Simulation Over One-counter Nets is PSPACE-Complete  
*Piotr Hofman, Sławomir Lasota, Richard Mayr, and Patrick Totzke*  
515

Optimal Constructions for Active Diagnosis  
*Stefan Haar, Serge Haddad, Tarek Melliti, and Stefan Schwoon*  
527
The 33rd international conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2013) was held at the Indian Institute of Technology, Guwahati, from December 12 to December 14, 2013.

The program consisted of 5 invited talks and 40 contributed papers. This proceedings volume contains the contributed papers and abstracts of invited talks presented at the conference. The proceedings of FSTTCS 2013 is published as a volume in the LIPIcs series under a Creative Commons license, with free online access to all, and with authors retaining rights over their contributions.

The 40 contributed papers were selected from a total of 111 submissions. We wish to thank the program committee for its efforts in carefully evaluating and making these selections. Names of PC members and external reviewers are given in the next few pages. We also wish to thank all those who submitted their papers to FSTTCS 2013.

We are particularly grateful to the invited speakers: Venkatesan Guruswami (CMU), Martin Hofmann (LMU Munich), Subhash Khot (NYU), Stephan Kreutzer (TU Berlin) and Kazushige Terui (Kyoto, Japan), who readily accepted our invitation to speak at the conference.

On the administrative side, we would like to thank to the organizing committee led by Prof. R. Inkulu (IIT Guwahati), who put in many months of effort in ensuring excellent conference arrangements at the IIT Guwahati campus. We also thank the Easychair team whose software has made it very convenient to do many conference related tasks. Finally, we thank the Dagstuhl LIPIcs staff for their coordination in production of this proceedings, particularly Marc Herbstritt who was very prompt and helpful in answering our questions.

Anil Seth and Nisheeth K. Vishnoi
December 2013
Conference Organization

Program Chairs

Anil Seth (IIT Kanpur, India)
Nisheeth K. Vishnoi (Microsoft Research, India)

Program Committee

Manindra Agrawal (IIT Kanpur, India)
Arnab Bhattacharyya (DIMACS, Rutgers and IISc, Bangalore)
Elisa Celis (Xerox Research Centre, India)
Anupam Gupta (CMU)
Prahladh Harsha (TIFR, Mumbai)
Swastik Kopparty (Rutgers)
Meena Mahajan (IMSc, Chennai)
Raghu Meka (IAS, Princeton and DIMACS, Rutgers)
Yogish Sabharwal (IBM Research, India)
C. Seshadhri (Sandia National Lab, CA)
Ola Svensson (EPFL)
Madhur Tulsiani (TTI, Chicago)
Laszlo Vegh (London School of Economics)
Thomas Vidick (MIT)
David Williamson (Cornell)

Mohamed Faouzi Atig (Uppsala, Sweden)
Roberto Bruni (Pisa, Italy)
Arnaud Carayol (Institut Gaspard-Monge, France)
Anuj Dawar (Cambridge, UK)
Laurent Doyen (ENS Cachan)
Deepak D’Souza (IISc, Bangalore)
Deepak Garg (Max Planck, Germany)
Dan Ghioca (Birmingham, UK)
Hugo Gimbert (LaBRI)
Ugo Dal Lago (Bologna, Italy)
Ranko Lazic (Warwick, UK)
Gopalan Nadathur (Minnesota, USA)
K. Narayan Kumar (CMI, Chennai)
R. Ramanujam (IMSc, Chennai)
Szymon Torunczyk (Warsaw, Poland)
Conference Organization

Organizing Committee

R. Inkulu (IIT Guwahati), Chair
Purandar Bhaduri (IIT Guwahati)
Santosh Biswas (IIT Guwahati)
Benny George (IIT Guwahati)
Diganta Goswami (IIT Guwahati)
External Reviewers

- Faried Abu Zaid
- Jade Alglave
- V Arvind
- David Baelde
- Paolo Baldan
- Pablo Barceló
- Dietmar Berwanger
- Markus Blaeser
- Didier Caucal
- Deeparnab Chakrabarty
- Karthik Chandrasekaran
- Thomas Colcombet
- Yuxin Deng
- Andrew Drucker
- Marco Faella
- Nathanaël Fijalkow
- Vojtěch Forejt
- Andrew Gacek
- Serge Grigorieff
- Gregory Gutin
- Peter Habermehl
- Ichiro Hasuo
- Petr Jančar
- Lukasz Kaiser
- Telikepalli Kavitha
- Bartek Klin
- Roman Kontchakov
- Arpita Korwar
- Amit Kumar
- Dietrich Kuske
- Carl Leonardsson
- Paul Blain Levy
- Anthony Widjaja Lin
- Kamal Lodaya
- Anand Louis
- Yury Makarychev
- Amaldev Manuel
- Arie Matsliah
- Paul-André Mellies
- Matthias Mnich
- M. Raj Mohan
- Gonzalo Navarro
- Vivek Nigam
- Luca Aceto
- Antonios Antoniadis
- Eugene Asarin
- Christel Baier
- Suman Bandyopadhyay
- Djamal Belazzougui
- Amey Bhangale
- Christopher Broadbent
- Venkatesan Chakaravarthy
- On Siu Chan
- Namit Chaturvedi
- Samir Datta
- Kashyap Dixit
- Alina Ene
- Stephan Falke
- Tamas Fleiner
- Zachary Friggstad
- Juergen Giesl
- Manoj Gupta
- Stefan Göller
- Matthew Hague
- Szymon Hummel
- Neil Jones
- Prateek Karandikar
- Felix Klaedtke
- Naoki Kobayashi
- Eryk Kopczynski
- Egor V. Kostylev
- Mrinal Kumar
- Salvatore La Torre
- Jerome Leroux
- Kevin Lewi
- Alberto Lluch-Lafuente
- Michele Loreti
- P. Madhusudan
- David Manlove
- Alberto Marchetti-Spaccamela
- Richard Mayr
- Julian Mestre
- Fabio Mogavero
- K Narayan Kumar
- Alantha Newman
- Yahav Nussbaum